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NORTHEAST ELECTRONICS

A DIVISION OF NORTHERN TELECOM, INC.

INSTRUCTION MANUAL

MODEL 4101

IDENTIFIER

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SECTION 1

GENERAL DESCRIPTION

1.1 This manual provides operating and maintenance instructions for the Model 4101 Identifier, Northeast Electronics part number A4101-00-900

1.2 APPLICATIONS

1.3 The Model 4101 can be used to identify any point in a telephone office switch train which has a dc path to the signaling source during the dialing portion of a call. That is, the Model 4101 automatically recognizes and displays the identities of the specific telephone equipment components actually used in servicing individual calls through common control offices. By identifying such components, the Model 4101 simplifies the diagnosis of call completion failures within an office and poinpoints failures to specific equipment units.

1.4 Automatic identification by the Model 4101 is particularly helpful when completion problems exist in office components which are not used for the full duration of a call, for example:

- .. Registers;
- .. Register Senders/Receivers;
- .. Directors;
- .. Touch Tone-to-Dial Pulse Converters;
- .. Similar, shared items which participate in each call only "on demand".

Troubles in such items are often difficult to detect and locate by normal signal tracing techniques.

1.5 The Model 4101 Identifier is used during troubleshooting in conjunction with any two-wire Routiner, such as the Northeast Electronics 41 series of Service Analyzer Units. The Identifier operates on each call placed by the Routiner, and shows the telephone equipment item connected to the line during each call. If a call fails, the identification data can be used to isolate the faulty equipment for rapid repair and restoration to service.

1.6 Capacity for identifying any one of up to 100 possible equipment connections on each call is included in the standard Model 4101. Optional Expander Modules can be added easily at any time to increase capacity in blocks of 100 to a maximum of 800 connection points.

1.7 The Identifier is designed for use by both maintenance and service analysis personnel...in troubleshooting equipment failures and in measuring service levels being delivered by operational equipment. The unit is fully automatic and requires no operator action except to note the identification readout on failed calls.

1.8 A typical application of the Model 4101 is shown in Figure 1-1. In this application, the Identifier is connected to the line bridging jack of a 41 series Service Analyzer Unit. A single sense wire is brought to a connector on the Model 4101 from each of the telephone equipment connection points to be identified. For example, the inputs to all register/senders in an office might be sense-wired to the Identifier. Each sense wire has a pre-assigned number (corresponding to its connector pin number) which appears on the Identifier's digital readout when that wire's telephone equipment is connected to a line during a call.

1.9 The Identifier is controlled by activity at the Service Analyzer's line jack. When a called number is outdialed by the analyzer (DP, TT, or MF), the Identifier transmits a recognition signal into the line. This signal passes through the telephone switching matrix to the common equipment then present on the line. Thus, the recognition signal appears on the Identifier's sense wire associated with the common equipment.

1.10 The Identifier performs a validity check on the recognition signal received over any sense wire and then displays the number of the telephone equipment assigned to the current call. The number remains displayed until a new call is initiated by the Service Analyzer Unit.

1.11 If a fault condition is detected by the Service Analyzer Unit, the user simply looks at the Identifier readout to determine the number of the specific telephone equipment item that was used on the failed call.

1.12 FUNCTIONAL DESCRIPTION

1.13 Figure 1-2 is a flow diagram of the basic operations performed by the Identifier. After the "power on" sequence, four distinct states are entered sequentially as follows:

.. State 1 = ON HOOK (Idle)

.. State 2 = OFF HOOK

.. State 3 = Transmit

.. State 4 = Identify

The Identifier cycles through the four states each time a test call is transmitted from the associated Routiner. During State 1, the previous recognition is displayed unless power has been removed and reapplied. In this case 0.0.0.is displayed.

1.14 When an OFF-HOOK condition is detected, State 2 is entered and the display is blanked. If a Dial Pulse (DP) or Touch Tone (TT) is detected, State 3 is entered immediately since this indicates that dialing is in progress. Otherwise, State 3 is entered three seconds later if neither DP or TT dialing is detected.

1.15 During State 3, a 12 kHz tone is transmitted from the Identifier to the common equipment under test during the first interdigit time. If a valid tone is received from the common equipment sense line, transmitting ceases and State 4 is entered. If a valid tone is not received within 200 milliseconds, State 4 is entered automatically.

1.16 During State 4, the display is unblanked and the identification is displayed on the front panel indicators. For a valid response, the number assigned to that sense line is displayed. If the identification is not valid (for example, something other than 12 kHz is received or excessive noise or low level signal), decimal points are illuminated with the number. If no signal is received following transission of the 12 kHz signal, the display consists of three zeros with three decimal points.

1.17 When the Identifier senses an ON HOOK condition, it enters State 1 again and retains the previous display until power is removed or another OFF HOOK condition is sensed.

1.18 PHYSICAL DESCRIPTION (See Figure 1-3).

1.19 The Model 4101 Identifier is a modular unit consisting of an aluminum housing, a mother board and four plug-in pc boards. An additional board may be added to increase the line handling capability from 100 to 200 lines. If data is to be supplied to an output device (modem, teleprinter, etc.), an option module is also required. Thus, up to six plug-in modules may be used as follows:

		Part Number
1.	Power Supply Module	4101-00-313
2.	Transmitter Module	4101-00-315
3.	Logic Module	4101-00-316
4.	Diode Module	4101-00-312
5.	Diode Module (Optional)	4101-00-312
6.	Option Module	

1.20 If more than 200 lines are to be served, an extender card with a single rear panel connector is used in place of the second Diode Module. An Expander Module is cable-connected to the Identifier. This allows up to 7 additional Diode Modules to be inserted in the remote expander, providing identification for up to 800 lines total.

1.21 The front panel contains a power ON/OFF switch, a self-test pushbutton and a three digit display. The display consists of independent, 7-segment indicators with associated LED's for decimal point rotation. The three LED's are illuminated whenever an invalid signal is received by the Model 4101.

1.22 The rear of the Model 4101 comprises the panels attached to the individual modules. The modules are plugged into the mother board from the rear and are secured to the cabinet with screws. The mother board increases reliability by eliminating internal wiring. Test points and associated adjustments are accessible from the rear.

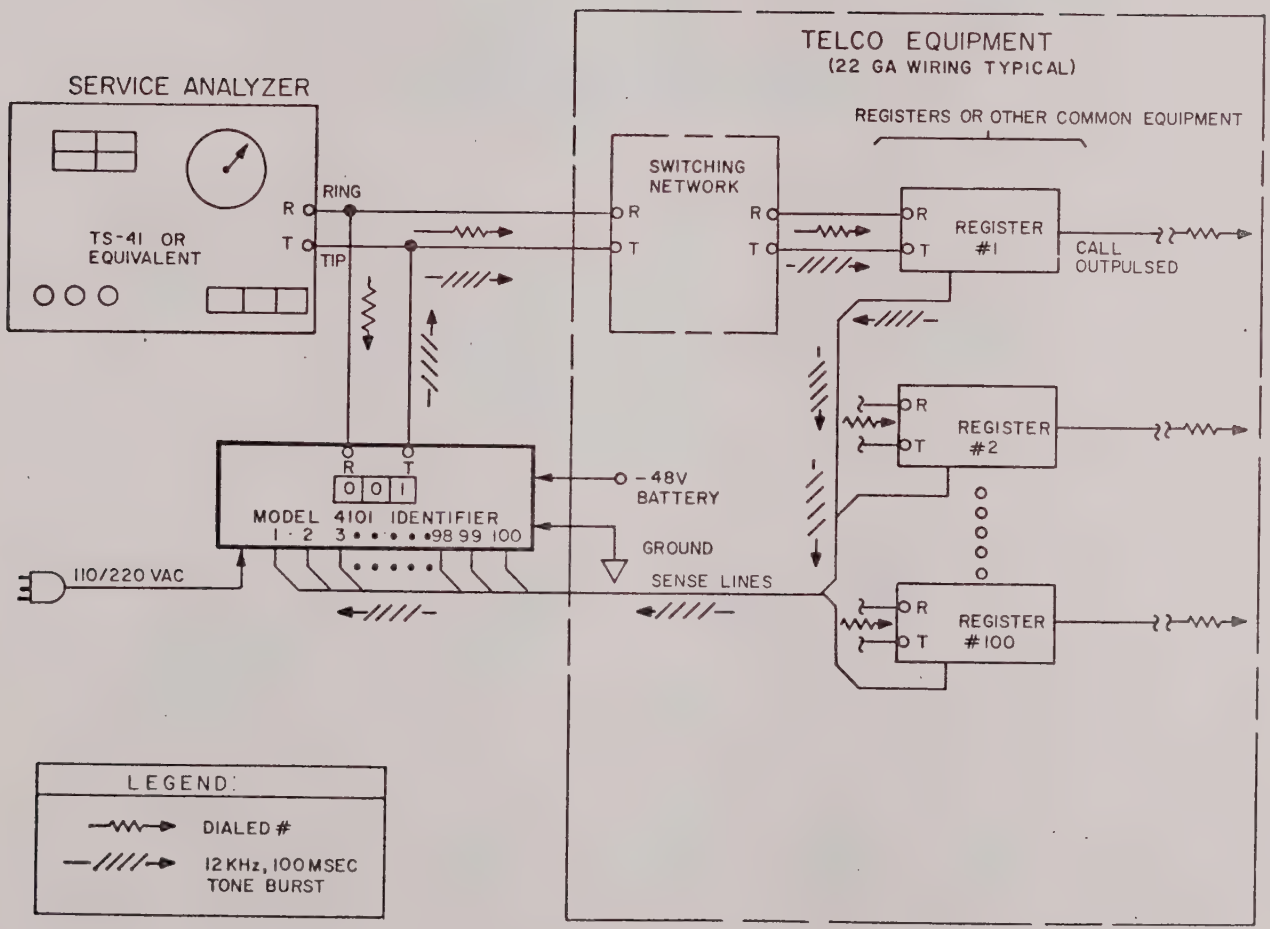

Figure 1-1 Typical Application

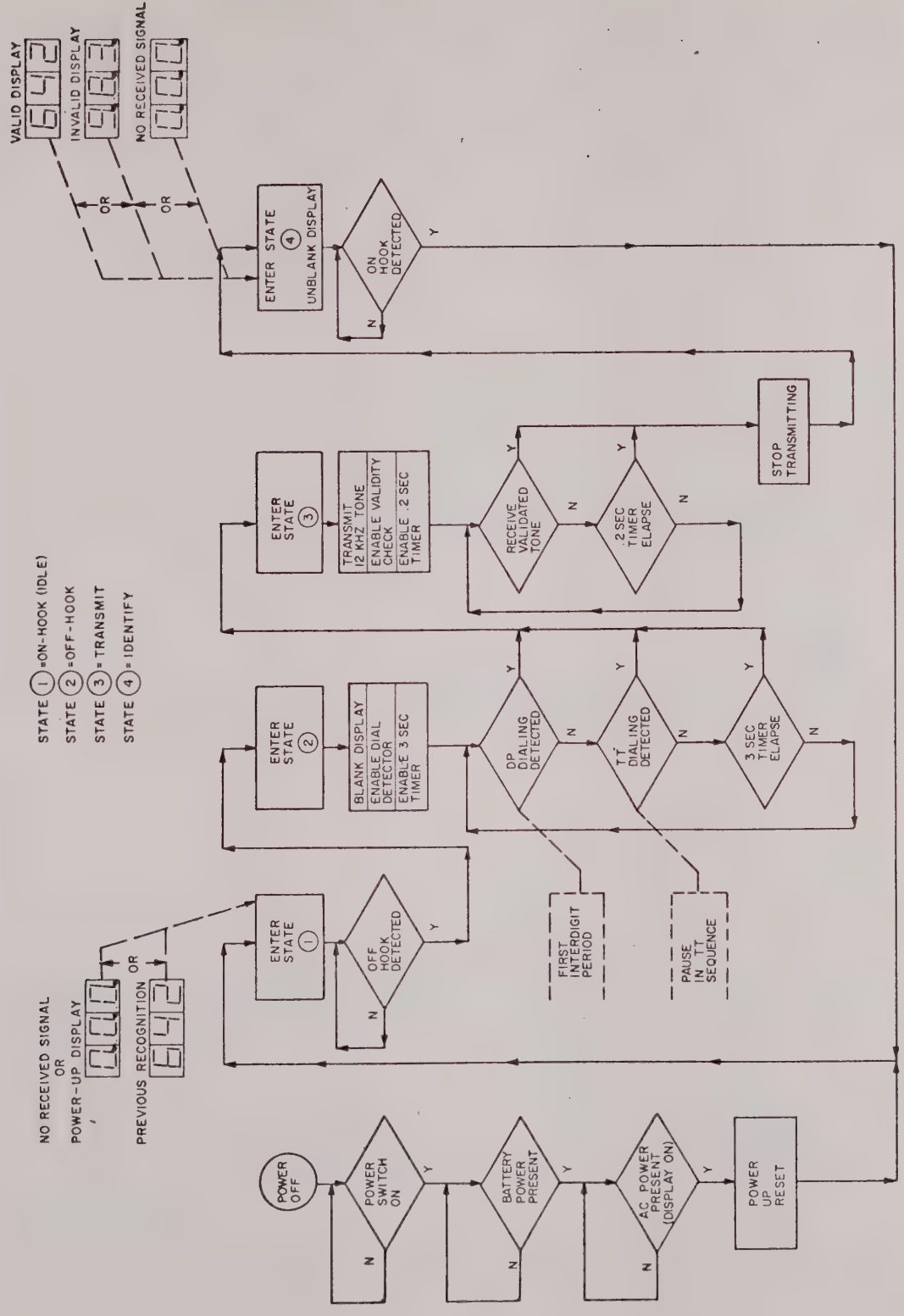

Figure 1-2 Flow Diagram

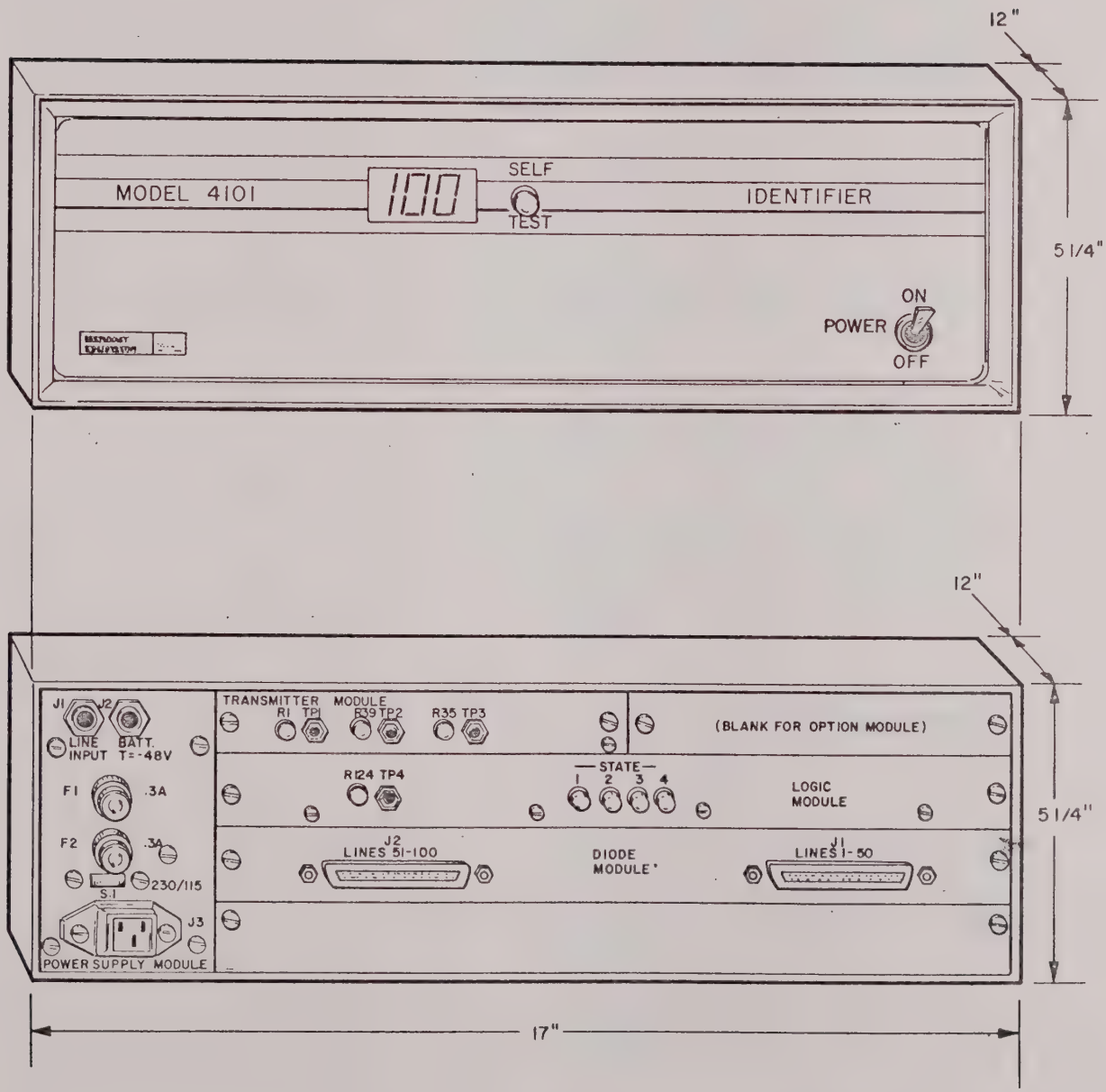

Figure 1-3 Front & Rear External Views

SECTION 2

SPECIFICATIONS

2.1 Major specifications of the Model 4101 Identifier are listed below.

2.2 ELECTRICAL PERFORMANCE

Capacity: 100 points standard. 200 points with second Diode Module. Up to 800 points maximum with optional expander unit and one 100-point module.

Sense Inputs: May be wired to any point which has a metallic dc path to the Routiner during the identification interval.

Operating Modes:

a. Automatic initialization when power is applied. Displays 0.0.0.

b. For dial pulse (DP) calls, identification occurs during first interdigital period.

c. For TT or MF calls, identification occurs: (1) after end of complete dialing sequence, or (2) during any interdigital pause of at least 350 milliseconds.

d. If no dialing is detected, identification is attempted approximately 3 seconds after Routiner goes OFF HOOK.

e. Invalid identification is shown by lighting all decimal points. Absence of any valid identification signal if shown by lighting all zeros on readout, including decimal points.

f. Automatic reset by sustained ON HOOK of at least 0.5 second by Routiner.

g. Self test can be done any time. Proper self test shown by lighting all 8's on display.

Recognition Signal: The recognition signal does not interfere with normal telephone office operation. It is a tone burst lasting less than 200 milliseconds, transmitted at 10 V peak.

2.3 INTERFACES

Telephone Line Interface:

a. T/R connection to call originating line via 310 cord to line bridging jack on Routiner.

b. Off-Hook recognized when both Tip and Ring are more negative than -5.5 Vdc.

c. Minimum TT and MF levels are -10 dBm into 600 ohms.

Office Battery & Ground Interface: Requires 310 cord connection to battery (nominal -48 Vdc) on tip and ground on sleeve. Both battery and ground must be connected in order to enable ac power turn on.

Sense Wire Interface: A sense wire can be any length; however, length of total loop from Identifier LINE INPUT jack, through Routiner and telephone equipment, back to Identifier sense wire input must be less than approximately 250 feet for offices using 22 gauge wiring.

2.4 ROUTINER REQUIREMENTS

Routiner (service analyzer) used with the Model 4101 Identifier must meet the following requirements.

Dial Pulse Operation:

a. Any combination of pulsing rate and percent break within the shaded area of Figure 2-1 may be used.

b. Interdigital time must be at least 350 milliseconds.

Touch Tone or MF Operation: Any combination of pulsing rate and percent tone shown in shaded area of Figure 2-2 may be used.

On-Hook: For all types of dialing, an on-hook interval of at least 0.5 seconds is required between calls to reset the Identifier.

2.5 POWER REQUIREMENTS

Input Power:	115 ± 10% at 20 watts, 50 to 60 Hz -48 Vdc at 250 mA
Internal dc Supplies:	+12 volts at 350 mA -12 volts at 350 mA -53 volts at 100 mA

2.6 ENVIRONMENTAL REQUIREMENTS

Operating Temperature Range:	0° to 50°C (32° to 112°F)
Operating Relative Humidity:	0 to 90% noncondensing

2.7 MECHANICAL DATA

Size:	17" w x 5 1/4" h x 12" d (43.2 cm x 13.3 cm x 30.5 cm)
Weight:	10 pounds (4.6 kg)
Mounting:	Portable or 19" rack mounting (standard) (22" rack mounting optional)

2.8 OVERLOAD PROTECTION

AC input protected with two 0.3 amp fuses; -48 volt dc input protected with 0.5 amp fuse; input ac and dc interlocked such that loss of dc removes ac input.

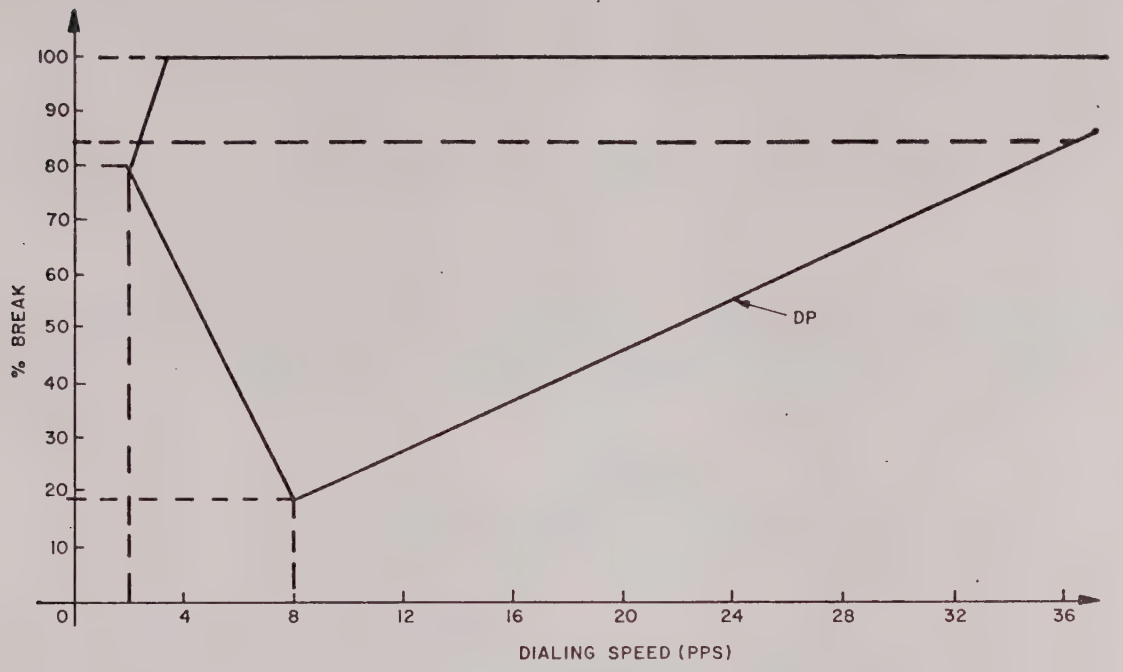

Figure 2-1 Typical DP Operating Range

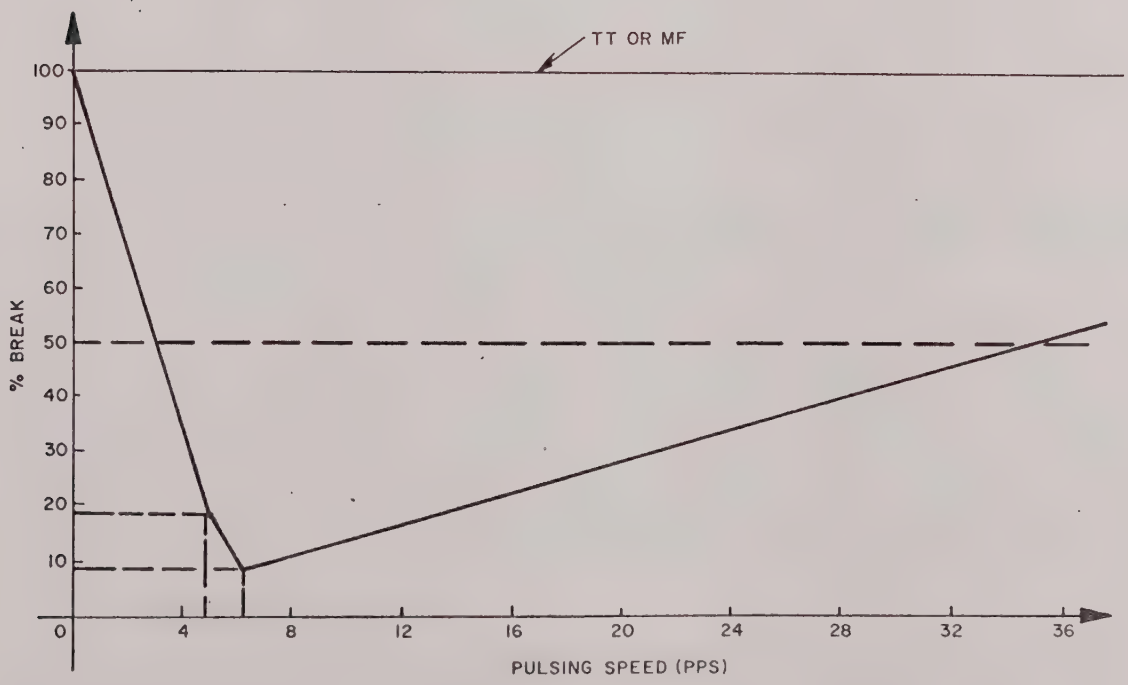

Figure 2-2 Typical TT & MF Operating Range

SECTION 3

INSTALLATION

3.1 This section provides information needed to install and check-out the Model 4101 to insure satisfactory performance.

3.2 VISUAL INSPECTION

3.2 After unpacking the Model 4101, visually check the exterior for any damage received during shipment. Check the rear panels and insure that all modules are secured in their correct locations by the screws on each end of the modules (refer to Figure 1-3 for module locations).

CAUTION

Do not attempt to operate the Model 4101 if damage is apparent.

3.4 LOCATION CONSIDERATIONS

3.5 The Model 4101 and its associated Routiner may be located anywhere, provided there is access to the following:

1. AC Power Source
2. Office Battery and Ground
3. Telephone Lines to be tested
4. LINE INPUT jack on Identifier and BRIDGE jack on TTS 41-3 Service Analyzer (or equivalent Routiner)

It is usually convenient to locate the Model 4101 and the Routiner together; however, they may be separated as long as the cable limitations described in paragraph 3.6 are not exceeded.

3.6 The total loop length from the Identifier LINE INPUT jack to the Routiner, through the office switching equipment, to the identification points and back to the Identifier should be as short as possible. The maximum allowable length of this loop is approximately 250 feet for offices using 22 gauge wiring. Excessive loop loss causes invalid displays during normal operation. Longer loop distances and other wire sizes can be accommodated by increasing the level of the recognition signal transmitted by the Identifier.

3.7 MOUNTING PROCEDURE

3.8 The Identifier may be rack mounted or used as a portable unit. In either case, provide a minimum of 1-inch clearance above and below for proper cooling.

3.9 PORTABLE OPERATION

3.10 Place the Identifier on a table, shelf, mobile cart or on top of other related equipment such as an associated Routiner. Provide 1-inch clearance for cooling.

3.11 RACK MOUNTING (See Figure 3-1)

3.12 The Identifier is supplied with brackets for mounting in 19-inch or 23-inch racks. Refer to Figure 3-1 and install the brackets as required to accommodate the rack being used.

3.13 EXTERNAL CABLING REQUIREMENTS (See Figure 3-2)

3.14 Figure 3-2 shows the external cabling required between the Identifier, the Routiner and the Common Control equipment. Cabling is shown for the three Northeast routiners which may be used with the Identifier (i.e. TTS 41SAU-2, 41-3 and 41SAU-4 Service Analyzers).

CAUTION

Do not perform the cabling procedures at this time. Cabling is combined with the checkout procedure in paragraph 3.30 to prevent possible damage to the Identifier.

3.15 REAR PANEL CONNECTORS & CONTROLS (See Figure 3-3)

3.16 The rear panel of the Identifier is illustrated in Figure 3-3 and the function of the associated controls and indicators used during installation are tabulated in Table 3-1.

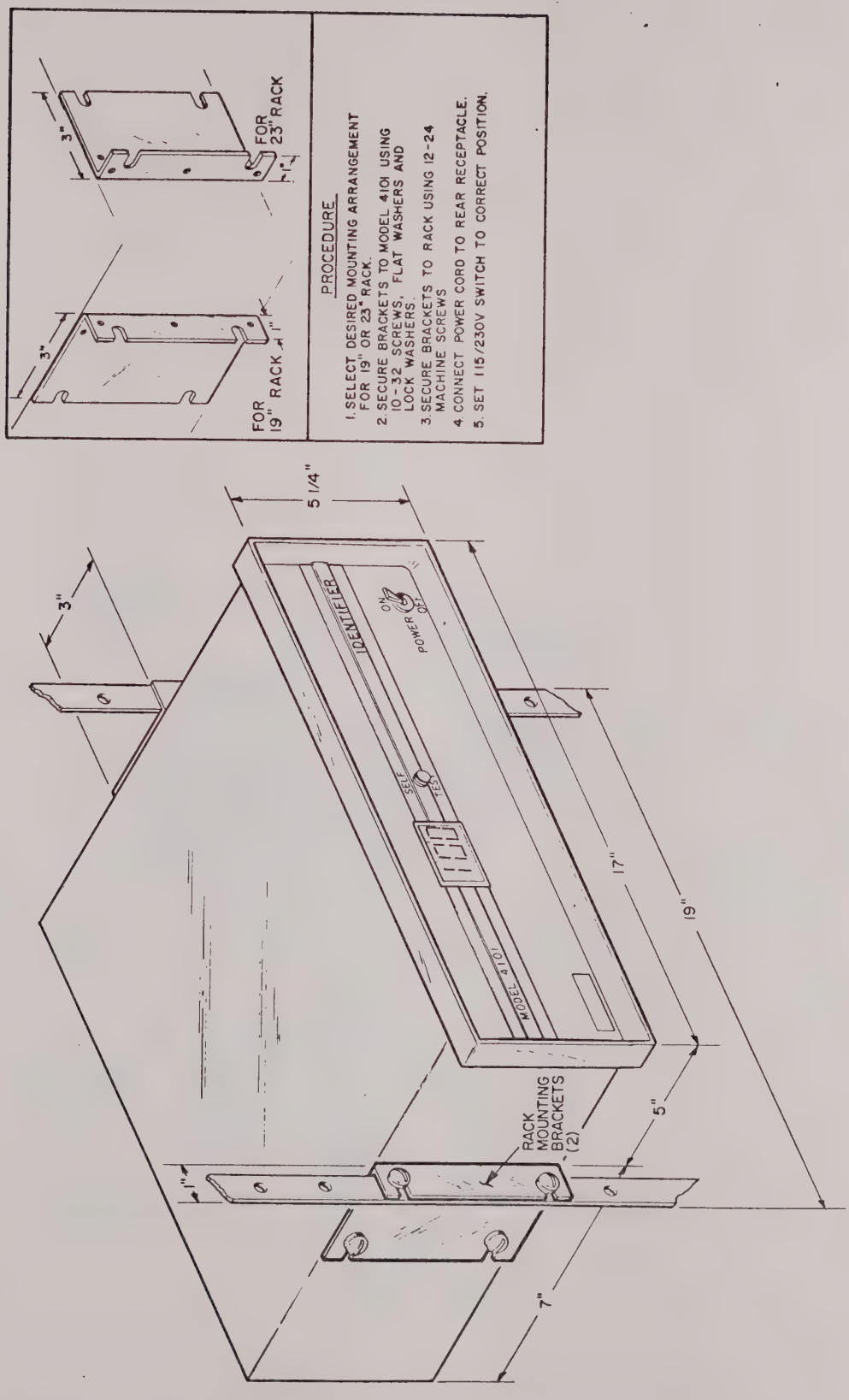

Figure 3-1 Rack Mounting (19" or 23")

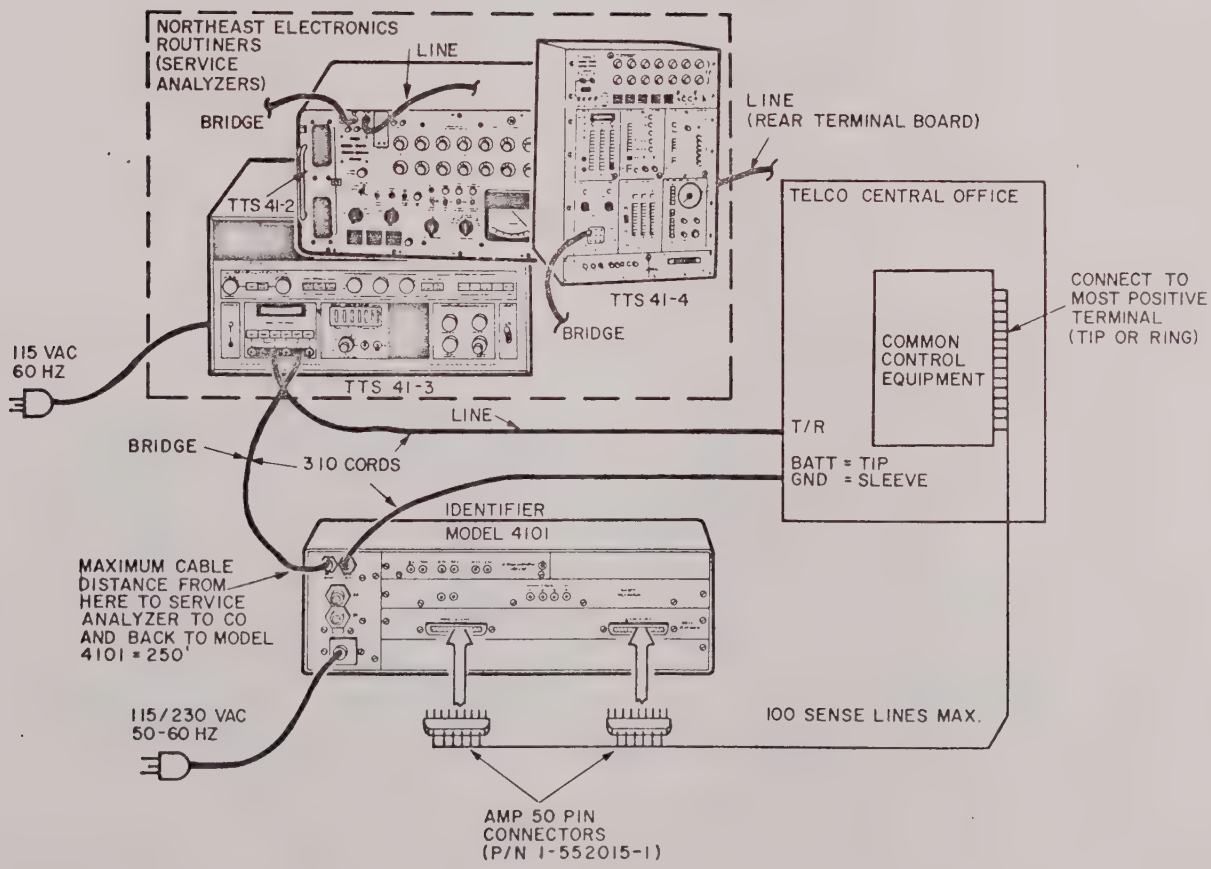

Figure 3-2 External Cabling

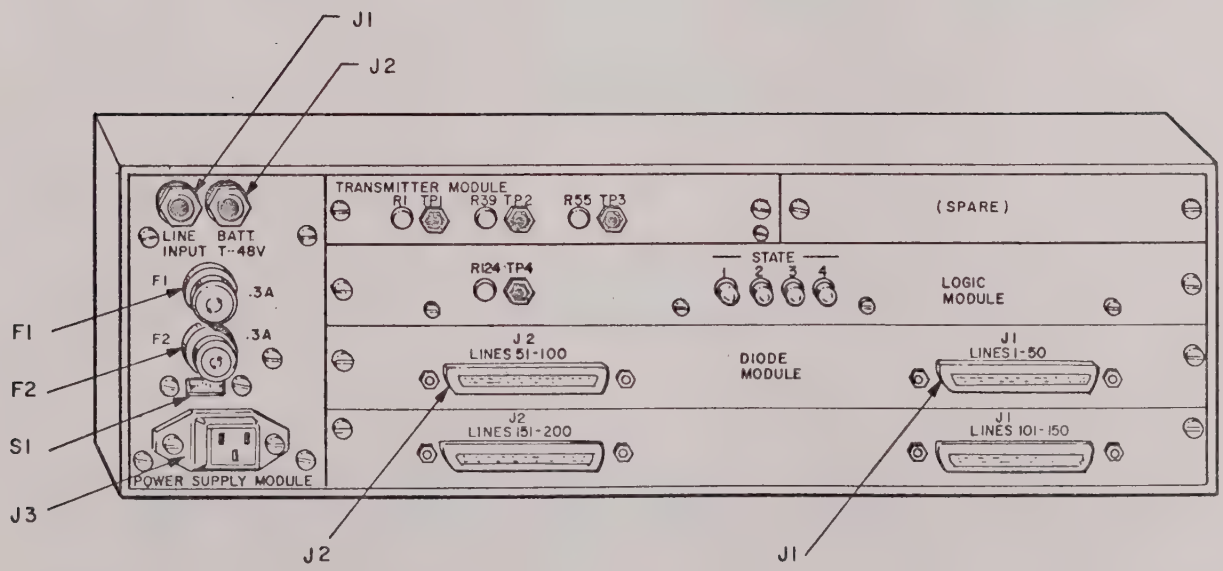

Figure 3-3 Rear Panel Controls & Connectors

TABLE 3-1

Rear Panel Connectors and Controls

Reference Designation	Component	Function
POWER SUPPLY MODULE:		
F1, F2	Fuse	AC line fuses, 0.3 ampere each.
J1	Line Input	310 jack input for bridging connection to the signaling unit.
J2	Battery -48V	310 jack input for connection to office battery. Tip = -48V, Sleeve = Ground.
J3	Power	115/230 Vac, 50-60 Hz power line input receptacle. Accepts the power cord supplied with the unit.
S1	115/230 Vac	Selects the ac input voltage range.
DIODE MODULE(S):		
J1	Lines 1-50	Accepts the first 50 sense wires from the office equipment to be identified.
J2	Lines 51-100	Accepts the second 50 sense wires from the office equipment to be identified.
EXTENDER MODULE:		
J3 (not shown in Fig. 3-3)	Remote Expander	Used to connect the Expander Unit option (for sense wires 101-800) to the Identifier.

NOTE: J1 and J2 perform identical functions on both Diode Modules when two are installed for 200 line inputs. If more than 200 lines are to be sensed, one Diode Module is used for lines 1 to 100 and the optional Remote Expander is used for lines 101 through 800, maximum.

3.17 AC POWER

3.18 The Identifier operates from 115 Vac or 230 Vac, 50 to 60 Hz power supplied by a NEMA standard 3-prong outlet plug on one end of a 7-foot power cord. The other end plugs into receptacle J3 on the Power Supply Module. The Identifier uses approximately 15 watts and contains two 0.3 ampere fuses for input power protection. A 115/230 Vac switch S1 connects the power source to the appropriate windings of an input power transformer in order to operate from either 115 or 230 Vac.

3.19 OFFICE BATTERY AND GROUND

3.20 This dc power is applied to connector J2 (BATT) of the Power Supply Module using a 310 cord connected to the Telco equipment. The tip is at -48 Vdc and the sleeve is at ground. Both BATT and AC Power must be applied before front panel power switch S1 can turn on the Identifier.

3.21 LINE INPUT

3.22 Connector J1 is patched to the Bridge input of the Routiner being used via a 310 cord. This tip and ring connection supplies the outpulsed calling digits to the Identifier and also allows the Identifier to transmit the test tone.

3.23 IDENTIFICATION TEST WIRES

3.24 Sense wires are connected between points to be identified and the LINES 1-50 and LINES 51-100 jacks (J1 and J2) on the Diode Module.

The identification points must have the following characteristics:

a. The office switching equipment must connect only a single identification point to the Routiner's outgoing line during the identification interval.

b. The paths established from the Routiner to the identification points must pass direct current (metallic).

3.25 Connections to all 100 Identifier input connector pins are not required. Unused connector pins are ignored by the Identifier.

3.26 If the Identifier does not receive the test tone from an identification point during a call, it displays three zeros and three decimal points. This condition can occur for one of the following two reasons:

a. A failure occurs in the office switching equipment.

b. The call is serviced by a unit of telephone equipment which is not connected to one of the Identifier's sense wires.

For the previous reasons, it is recommended that one identification point be connected to the Identifier for every normal call.

3.27 The sense wires are connected to the Identifier with 50-pin Amphenol connectors on the rear of the unit. Two connectors are used to accommodate the 100 available sense inputs of the standard Model 4101.

3.28 The number assigned to each identification point is established by connecting the respective sense wire to the numbered pin of a plug which mates with connector J1 or J2 on the rear of the Identifier. The lowest numbered pin of each connector corresponds to the lowest identification number of that group. Other identification numbers are assigned sequentially within the connector. Figure 3-3 locates the Identifier connectors which accept numbers 1 through 200.

3.29 For 200 connections, two identical Diode Modules are used. If more than 200 are desired, one Diode Module is used for Lines 1-100 and the Extender Module is connected to the optional Remote Expander via connector J3. The Expander can accommodate up to 700 additional inputs for a total of 800.

3.30 CABLING & CHECKOUT PROCEDURE

3.31 The following procedure provides an orderly method for cabling and checking out the Model 4101 Identifier. Perform the following steps:

1. Visually inspect the Identifier as described in paragraph 3.20.

2. Mount the Identifier as described in paragraph 3.7.

3. Connect ac and office battery power to J3 and J2 respectively. Insure that the 115/230 ac voltage selector switch on the Power Supply Module is in the correct position.

4. Place the front panel POWER switch to the ON (up) position. The readout should display three zeros plus three decimal points. If this condition is not observed, the Identifier is not operating properly. Check to be sure that all modules are inserted properly and that both power connections have been made properly.

5. Press the front panel SELF TEST button. The readout should be blank initially and after about three seconds should display three eights with decimal points extinguished. If these conditions are not observed, the Identifier is not operating properly. Check to be sure all modules are properly installed in rear of unit.

6. Turn the POWER switch off and connect the sense wire inputs as shown in Figure 3-2.

7. Connect the LINE INPUT jack to the line bridging jack of the Routiner being used. Place the Routiner in the on-hook (idle) condition.

8. Turn the POWER switch on and repeat the self test. If the self test is performed correctly in step 5 above, but fails with sense input wires connected, one or more of the sense input wires may be improperly connected. Check the connections and repeat the self test.

9. When the self test is correct, the Identifier is ready for operation as described in Section 4.

3.32 IDENTIFICATION OF SENSE WIRE CABLES

3.33 The two 25 foot sense wire cables supplied with the Model 4101 Identifier are identical and should be installed as described in paragraph 3.13. Each cable is terminated on one end with a connector which mates with the connectors on the rear panel of the Identifier. The other ends are unterminated. They should be connected to the equipment to be identified according to the following color code table. Note that each wire consists of a solid color and a tracer (striped color).

Table 3-2 Sense Wire Color Codes

(1) Identification No.	Solid Color	Striped Color (Tracer)
1	Blue	White
2	Orange	White
3	Green	White
4	Brown	White
5	Gray	White
6	Blue	Red
7	Orange	Red
8	Green	Red
9	Brown	Red
10	Gray	Red
11	Blue	Black
12	Orange	Black
13	Green	Black
14	Brown	Black
15	Gray	Black
16	Blue	Yellow
17	Orange	Yellow
18	Green	Yellow
19	Brown	Yellow
20	Gray	Yellow
21	Blue	Violet
22	Orange	Violet
23	Green	Violet
24	Brown	Violet
25	Gray	Violet
26	White	Blue
27	White	Orange
28	White	Green
29	White	Brown
30	White	Gray
31	Red	Blue
32	Red	Orange
33	Red	Green
34	Red	Brown
35	Red	Gray
36	Black	Blue
37	Black	Orange
38	Black	Green
39	Black	Brown
40	Black	Gray
41	Yellow	Blue
42	Yellow	Orange
43	Yellow	Green
44	Yellow	Brown
45	Yellow	Gray
46	Violet	Blue
47	Violet	Orange
48	Violet	Green
49	Violet	Brown
50	Violet	Gray

(1) Connector Pin No.
(2) J1 cable connector corresponds to lines 1-50.
J2 cable connector corresponds to lines 51-100.

SECTION 4

OPERATION

4.1 This section provides information needed to operate the Model 4101 Identifier.

4.2 CONTROLS AND INDICATORS

4.3 The functions of front panel controls and indicators are described in Table 4-1 and illustrated on Figure 4-1.

4.4 The rear panel controls and indicators are normally used during installation only. Their functions are described in Table 3-1. Test points and adjustments are described in Section 6, Maintenance.

4.5 OPERATING INSTRUCTIONS

4.6 Operation of the Identifier consists of simply turning the power on and performing a self test at the beginning of each operating session. However, certain operating parameters are necessary for use with the Identifier. These parameters are described in Table 4-2.

4.7 The Identifier operates automatically on each call placed by the Routiner. If a particular unit of telephone equipment is identified for several failed calls, that equipment unit is probably defective and may be removed from service to repair.

4.8 Routiners such as the Northeast 41 Series Service Analyzers may be programmed to stop operation and hold when a fault condition is detected. In this situation, the Identifier displays the identification until the Routiner is reset manually. Unattended operation of the Routiner and Identifier is possible when using the Routiner's "hold on fault" mode.

TABLE 4-1

Front Panel Controls and Indicators

Reference Designation	Components	Function
S1	Power	Applies ac and office battery power. Both power sources must be connected for this switch to function.
S2	Self Test	Initiates the self test function. The Routiner must be in the on-hook state for the self test to function.
U1-U3	LED Display	Displays the number of the sense point reached during the last call. This display is present until another call is placed or power is turned off.

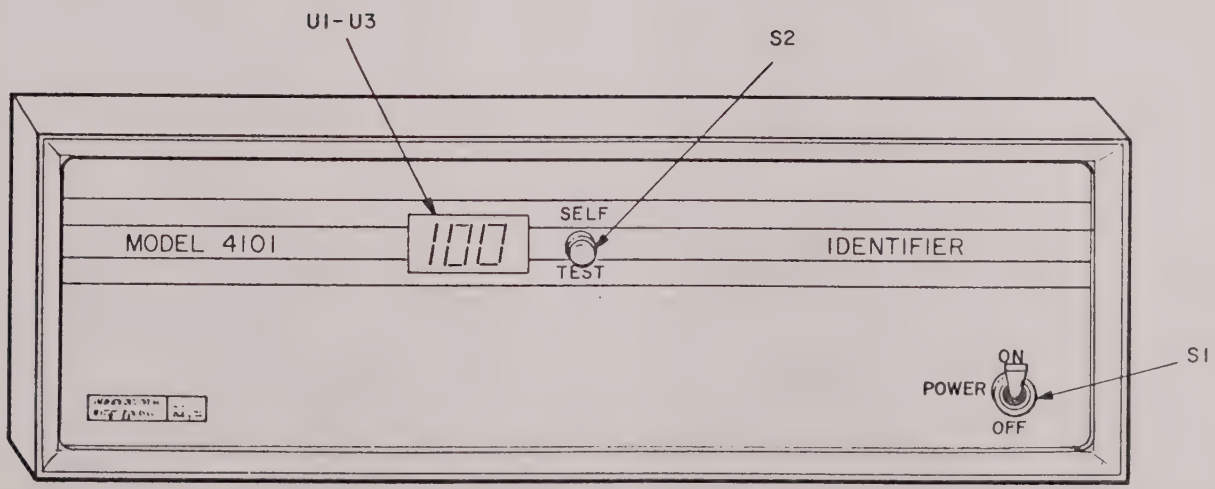

Figure 4-1 Front Panel Controls & Indicators

TABLE 4-2

Routiner Operating Parameters

Parameter	Dial Pulse	Touch Tone/MF
Pulsing Speed	Any combination within the shaded region of Figure 2-1.	Any combination within the shaded region of Figure 2-2.
Interdigital Time	350 milliseconds or greater	
On-hook time between calls	0.5 second minimum	0.5 second minimum
Wait-start-dial periods (TTS 41-3)	As desired	If a wait-start dial (WSD) period is programmed between digits of the dialed number, identification occurs during that period. Minimum WSD is 350 milliseconds. If a WSD is not included in the dialing program, identification occurs within 350 milliseconds after the end of the dialing sequence.

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